Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

A280.39
M34Am
Cop. 2

LIBRARY
CURRENT SERIAL RECORD
★ FEB 3 - 1958 ★
U. S. DEPARTMENT OF AGRICULTURE

A PROCEDURE FOR THE DETERMINATION OF CLEAN CONTENT OF GREASE WOOL BY USE OF THE 1¼" CORING TUBE

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Livestock Division

AMS-216

Agriculture--Washington October 1957

A PROCEDURE FOR THE DETERMINATION OF CLEAN CONTENT OF GREASE WOOL BY USE OF THE 1¼" CORING TUBE

By Henry R. Keller, Wool Technologist [1]

PREFACE

Core testing to determine the clean content of grease wool has been used successfully for a number of years. It has been utilized not only by the Commodity Credit Corporation in price-support and wool loan programs but also by individual growers to obtain the most accurate possible appraisals of their clips.

Because of the widespread interest in core testing, this publication has been prepared to provide information on the sampling procedures, laboratory techniques, and equipment involving the use of the 1¼" coring tube.

INTRODUCTION

In 1941 the Bureau of Customs developed a mechanical sampling device which could be used to obtain a representative wool sample from baled foreign wools for the determination of the amount of clean wool present in the bales. This device offered the best means of obtaining representative samples from our domestic wools packed in bags or bales. The Livestock Division at that time undertook a research program to investigate the core sampling method of wool appraisal for clean content. It proved to be the most accurate method yet known.

The procedure followed in these investigations was to use an electrically driven tube to take a sample (a number of cores) of wool from representative bags within a given lot. The cores drawn in the field formed a composite sample which was tested in the laboratory to determine clean content. The results were then compared with mill yields obtained by scouring the entire lots from which the cores were drawn.

All of the cores drawn in preliminary research were 3" in diameter and this method was adopted by the CCC in its official appraisal for clean content of wools that were placed in its 1944 support program.

One disadvantage of using the 3" cores was that while they gave reliable results, they made it necessary to sub-sample in the laboratory a cumbersome sample weighing as much as 150 pounds.

---

[1] Wool Standards Laboratory, Livestock Division, AMS, Denver 2, Colorado

As studies continued, the possibility of using tubes with smaller diameters was investigated. Tubes of 1¼" diameter cutting edge were used experimentally and found to be equally as accurate as the 3" tube, but they drew only one-sixth as much wool to make up a composite sample.

Further testing confirmed the accuracy of samples drawn with the 1¼" tube, and this tube was adopted for official testing in the CCC wool program in 1948 and 1952. The accuracy of this sampling method was further confirmed in extensive comparisons with processing and top-noil-waste yields.

At the present time studies using still smaller tubes are in progress and promising results have been obtained.

The following sampling and testing procedures are those used by the USDA Wool Laboratory in a routine analysis of grease wool for clean yield determination.

SAMPLING EQUIPMENT

(a) Motor.--The hand drill motor should have a 5/8" tapered shaft and a rated capacity of 300 rpm if of standard type, or a 450 rpm rating if of heavy duty type. The heavy duty type is preferable for continuous coring over long periods. The shaft should be fitted with a suitable chuck to drive the coring tube.

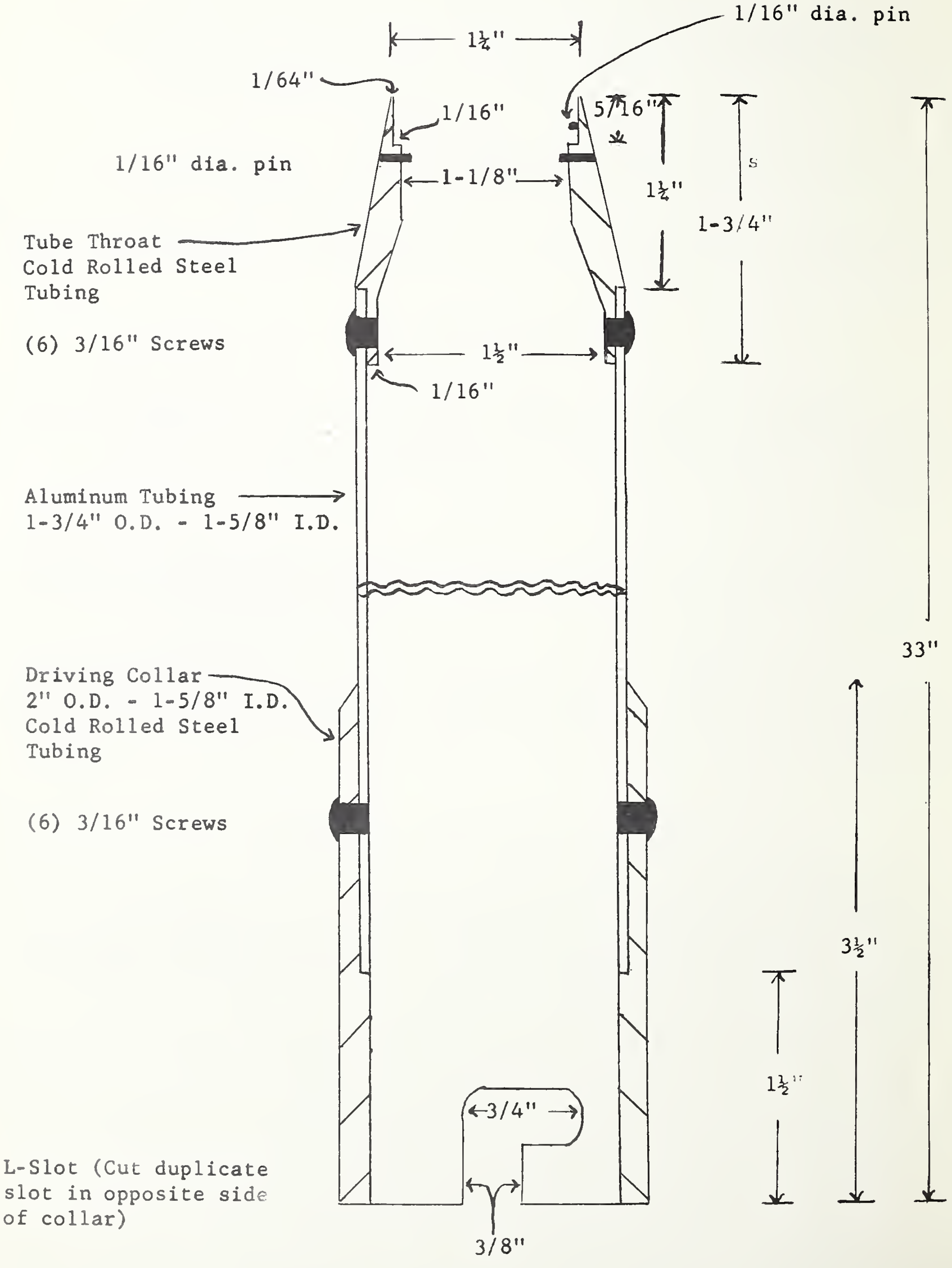
(b) Coring tube.--The 1¼" coring tube can be made of steel, aluminum, or plastic and is approximately 33" long. The aluminum tube is the preferred tube due to a weight difference. (See 1¼" coring tube diagram.)

(c) Cutting edge.--The cutting edge is a steel strip approximately 4" long and is bent into a circular blade 1¼" in diameter. This edge is held into the tube by means of a lock ring (see diagram, tube accessories) and may be resharpened by using a hand file. These blades are manufactured commercially.

LOTS SUITABLE FOR SAMPLING AND TESTING

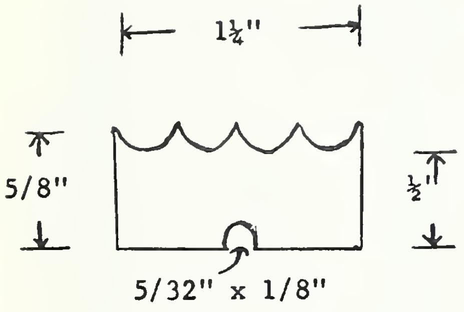
It is preferable that the wools to be core sampled be as uniform in grade and condition as possible. As a general rule, it is not practical to sample lots of less than 10 bags or 5 bales, or approximately 2,000 pounds of wool. Accurate testing of domestic graded wools as ordinarily packed requires a minimum of 100 cores per lot.

1-1/4" CORING TUBE

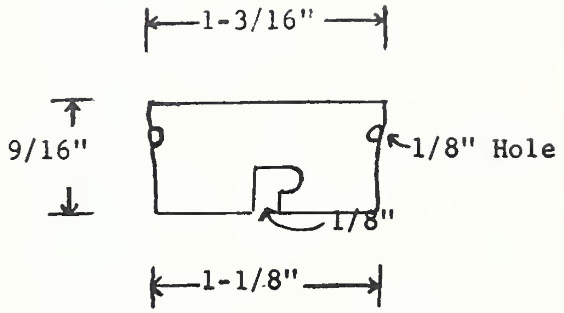


TUBE ACCESSORIES

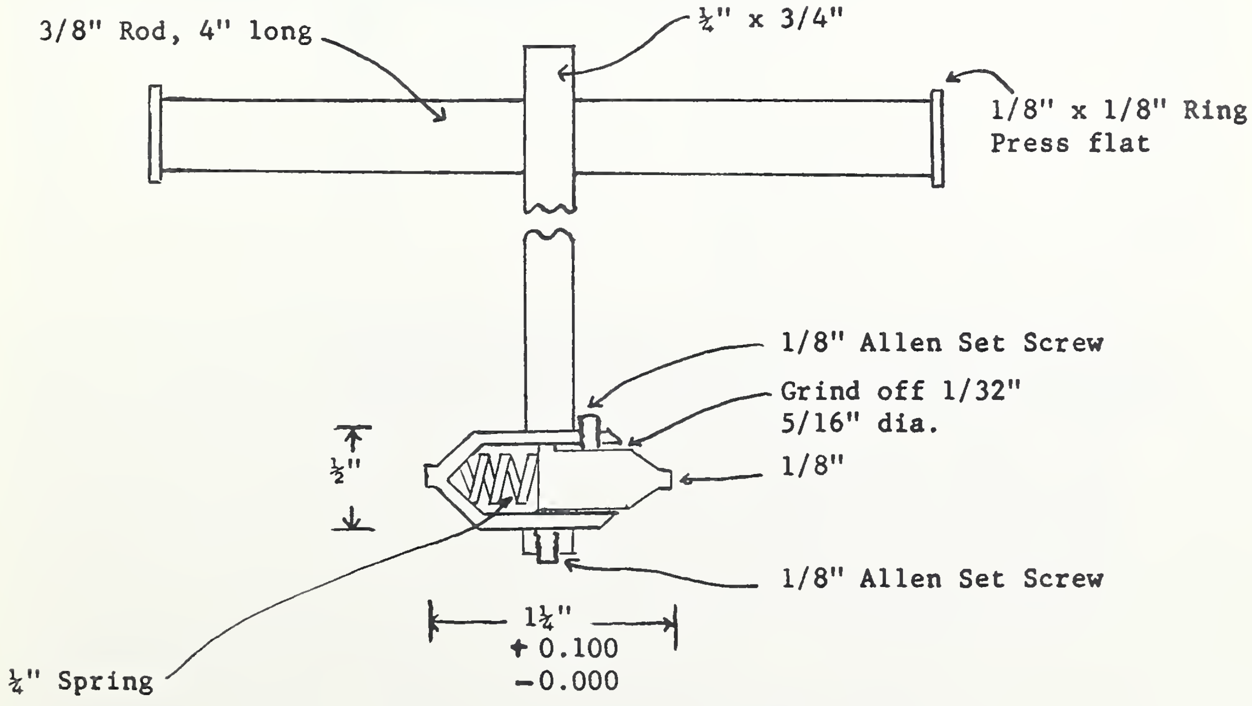
BLADE



LOCK RING



LOCK RING KEY



SAMPLING SCHEDULE

Bagged Lots

Number of bags in lot	Number of bags to core	Number of cores per bag*	Total cores
Less than 10	All	1/	100
10-15	10	10	100
16-25	15	8	120
26-40	18	8	144
41-70	20	8	160
71-100	22	7	154
101-150	32	5	160
151-200	35	5	175
201-300	40	5	200
301-400	50	4	200
401-500	60	4	240
501 & over 2/	-	4	-

Baled Lots

Number of bales in lot	Number of bales to core	Number of cores per bale*	Total cores
Less than 10	All	1/	100
10-30	10	10	100
31-60	15	7	105
61-100	20	6	120
101-150	25	5	125
151-200	30	5	150
201-300	35	5	175
301-400	40	5	200
401 & over	50	4	200

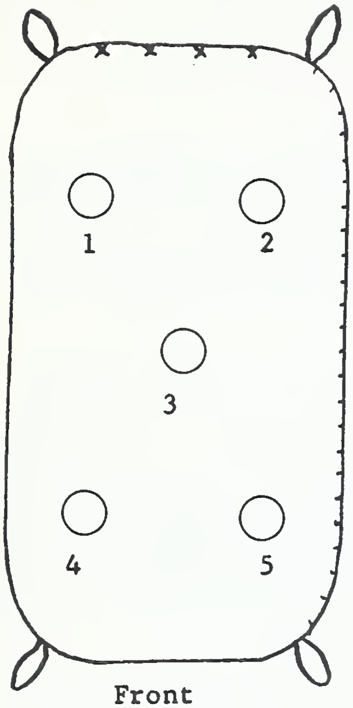
* Cores drawn from side of bag or bale using 1¼" coring tube

1/ Sample all bags or bales to make total of 100 cores

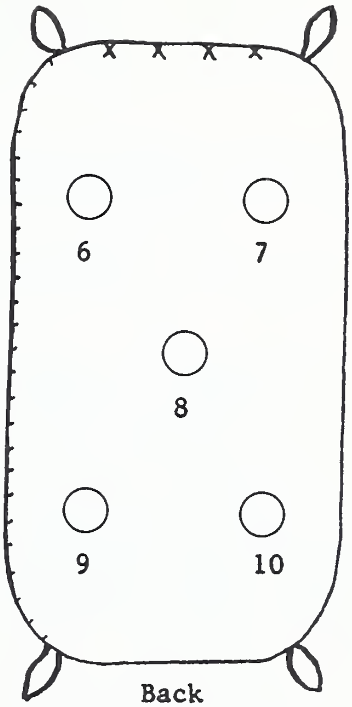
2/ Over 500 bags in lot, select 10 bags for each 100 bags in excess of 500

CORING POSITIONS

Bagged Lots



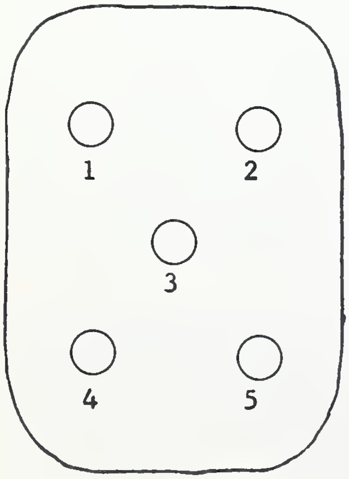
Front

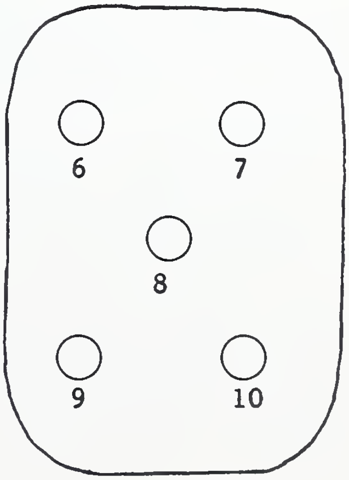


Back

10 Core Pattern - Core Positions 1 thru 10
8 Core Pattern - Core Positions 1 thru 8
7 Core Pattern - Core Positions 1, 2, 3, 4, 8, 9, and 10
5 Core Pattern - Core Positions 1 thru 5
4 Core Pattern - Core Positions 1 thru 4

Baled Lots





Use Bagged Lot Patterns

All cores should be drawn at 45° angle to bag or bale.
KEEP BLADES SHARP

Sample packaging.--As the cores are drawn they should be extruded from the tube into a moisture-proof container. Polyethylene plastic bags of .003 thickness are generally regarded as standard containers for core samples. All cores from a lot are put together in the container making up a composite sample for the lot. The container should then be tied, taped, or otherwise sealed to prevent the loss or gain in moisture content.

LABORATORY TESTING OF CORE SAMPLES FOR CLEAN YIELD DETERMINATION

Receiving, weighing, dusting, blending, and subsampling grease wool core samples.--The entire sample should be weighed as soon as it arrives at the laboratory. This immediate weighing is essential even though the sample cannot be processed beyond this phase for some time. In the event the sample must be stored for a while prior to processing, the record will show any moisture loss or gain.

If laboratory subsamples are to be drawn by hand, the entire sample should first be dusted. This may be accomplished by passing the entire grease core sample through a Wilson-type duster or a picker of similar action. While passing sample through the dusting machine remove and keep separate any hard tags that contain wool. Gross tags may be discarded. After the dusting operation has been completed, the sample will be separated into dusted wool, dust (drops through screens into collection box), and any hard tags removed by hand.

Weigh dusted wool, dust, and hard tags. After weighing discard dust and hard tags. The dusted wool should be blended and thoroughly homogenized by hand prior to subsampling. The subsamples for analyses should be drawn by taking random handfuls from all regions of the dusted mass. Each subsample drawn should be made up to weigh 300 grams, and three such subsamples should be analyzed for each lot's core sample that is to be tested. The three subsamples should be analyzed individually and the yield results combined to arrive at a yield for the entire sample.

Subsample scouring.--Each subsample should be given one scouring bath and a rinse bath. The subsample must be scoured and rinsed in such a manner that there is a minimum of fiber loss. This may be accomplished by placing the subsample in a mesh bag (16 mesh per inch is suitable), or metal screen of approximately the same mesh. Be sure that the scouring liquor and rinse water can penetrate all regions of the subsample and agitate the subsamples frequently with wooden paddle or other instrument. The wool should not be too confined, but be allowed to float freely in the scouring liquor. Remove and discard pieces of fleece strings or other gross impurities during scouring and rinsing including any large vegetable materials.

The scouring liquor should contain a .075 percent concentration of detergent and 0.75 percent concentration of soda ash and be maintained at 140° F. These percentages are approximate and may be varied according to scouring needs. The ratio of scouring liquor to wool should be at least 100-1. The rinse bath should be between 110° C - 120° C.

Subsample drying.--After the subsamples have been scoured and rinsed they should be placed in a centrifuge or spin dryer of some sort and the excess water removed. Place subsamples in a steam or electric dryer and reduce moisture content to approximately air dry (so that wool does not feel moist). After this drying period the subsamples should be allowed to come to moisture equilibrium with the surrounding atmosphere. Reasonable equilibrium may be achieved in 1 to 2 hours. The subsamples are then ready to be weighed (scoured weight) and aliquots taken for residual impurities analysis.

Analysis for residual impurities.--After weighing the scoured subsamples, each subsample should have the following aliquots drawn from it to determine the amounts of residual impurities:

1 - 10 gram aliquot for ash (sand) content
1 - 10 gram aliquot for extractable grease content
1 - 20 gram aliquot for vegetable matter content
1 - 100 gram aliquot for moisture content

In the event that a subsample does not yield 140 grams of scoured wool, draw ash, vegetable matter, and extractive aliquots and use remainder for moisture testing.

Testing residual impurity aliquots

1. Ash--Place 10 gm. scoured aliquot in a porcelain crucible (Coors Size 3 is suitable) and char over a burner until no more volatile matter is produced. Ignite charred specimens in a muffle furnace at 600°-700° C. until the carbon has been burned off and a white ash remains. Cool and weigh to nearest 1 mg. Weighing may be accomplished by carefully brushing ash into a tared weighing pan.

2. Grease extraction--Place 10 gm. scoured aliquot in a Soxhlet apparatus and extract for 20 siphonings using 95 percent neutral alcohol, denatured alcohol, or Synasol (a commercial solvent); if one of the latter two solvents is used it may be well to make a blank determination of residue for use as a correction. At the end of 20 siphonings evaporate remaining solvent from the extract, dry the residue for 10 minutes in conditioning oven at 100 to 105° C., cool, and weigh to nearest 1 mg.

3. Vegetable matter--Place 20 gm. scoured aliquot in a 800 ml. pyrex beaker. Pour in approximately 300 mls. of 10 percent NAOH solution (boiling). Allow to remain for 3 or 4 minutes, stirring frequently. Add 300-400 mls. of cold water and allow to settle. Decant solution through a 40-mesh filter (tea strainer type is suitable, or cheesecloth), holding the settled sand in the beaker. Assist filtration by agitation of the solution on the filter. Then rinse thoroughly with a strong spray or stream of warm water. Remove rinsed material to a sheet of aluminum foil (3" x 3"), place in evaporating dish and dry to constant weight at 105-110° C. The aluminum foil obviates the necessity for tared evaporating dishes; however, if the vegetable material is heavy in the scoured product (5% or higher) place weighed material in crucible, ignite at 600-700° C. to a white ash, weigh, and calculate ash-free vegetable material.

4. Moisture--Place 100 gm. scoured aliquot in drying oven and dry to constant weight. Constant weight may be obtained by drying at 135°-155° C. for 20 minutes. Weighing should be done in the oven, if possible. If not, remove aliquot from oven and immediately place into a container that can be sealed, cool, and weigh. All weighings of impurities should be made to the nearest 1 mg. if possible.

Yield calculation.--The following example is that of the calculation of a 1¼" core sample by the previously described technique:

Laboratory receiving weight		4082.4 grams
Dusted wool weight	3671.4 grams	
Dust	264.0 grams	
Tags (hard)	87.0 grams	
Total	4022.4 grams	

This particular sample shows 60 grams loss in receiving weight. This loss is a combination of "fly" and moisture loss.

The three 300-gram subsamples drawn for processing from the 3671.4 grams of dusted wool represent 24.51% of the dusted wool. Consequently 24.51% of the total dust (264 gms) must be apportioned to the dusted wool and also 24.51% of the hard tags must be apportioned to the subsamples.

Thus, three 300-gm dusted subsamples represent 1000.76 gms of the wool in its original condition (before dusting). The weights would be as follows:

3 300-gm dusted grease subsamples	900.00
Dust (.24514 x 264)	64.72
Tags (.24514 x 87)	21.33
Air loss (.24514 x 60)	14.71
Total (.24514 x 4082.4)	1000.76

In other words a single 300-gm dusted subsample represents 333.59 gms of original wool.

The air-dry scoured weights of the individual subsamples were 144.50 gms, 143.75 gms, and 145.00 gms, totaling 433.25 grams. The percent impurities measured in the subsamples was as follows:

	Test 1	Test 2	Test 3	Average
Moisture	6.75	6.51	7.12	6.79
Ash	1.29	1.12	1.38	1.26
Vegetable matter	1.75	1.57	2.00	1.77
Extracts	1.16	1.07	1.34	1.19
			Total impurities	11.01

During laboratory processing there is inevitably some small fiber loss caused by the handling of the sample; therefore, 0.10 is subtracted from the total impurities percentage to compensate for this loss, making the total impurities 10.91 percent. (The 0.10 percent was derived from data collected on tests of fiber loss from handling.) Subtracting 10.91 from 100 we find the three subsamples contain 89.09 percent pure wool based on the scoured air-dry weights. At this point the amount of standard clean wool in the subsamples must be calculated. Standard clean wool is defined as the weight of wool containing 14 percent impurities (12% moisture, 1.5% extractable matter, and 0.5% ash) or having a pure wool content of 86%. Now it is necessary to calculate the weight of the subsamples containing 14% impurities. By dividing 89.09 by 86.00, a factor of 1.03593 is calculated. 1.03593 times 433.2 equals 448.82 (standard clean wool in the subsamples). This figure (448.82) is the standard clean wool in the dusted subsamples and to it must be added the standard clean wool in the dust and tags.

To find the clean wool in the dust it is first necessary to calculate the percent dust on dusted wool. Since there were 3671.4 grams of dusted wool and 264.0 grams of dust in the entire sample, the percent dust on dusted wool is 7.2.

Percent clean wool (14%) in dust from
1¼" core samples

Percent dust on dusted wool	Percent wool in dust
0-1	23
1-3	19
3-5	16
5-7	13
7-10	11
10-15	8
15-20	6
20-25	5
25-35	4
35 and over	3

The table was the result of analyzing numerous samples of dust to determine the amount of standard wool present.

By consulting the above table it is seen that if there is 7.2 percent dust on dusted wool then there is 11 percent wool in the dust. 64.72 (dust in the subsamples) times .1100 equals 7.12 grams of standard wool in the dust. Since there were 21.33 grams of tags for the three grease subsamples, 21.33 is multiplied by .136 (factor for tags) which equals 2.90 (standard wool in the tags). So the total standard wool in the three subsamples is 448.82 + 7.12 + 2.90 = 458.84.

The total weight of standard wool produced by the three subsamples (458.84) is divided by the equivalent grease weight (1000.76) thus arriving at a clean yield percent of 45.85.

The clean yield percent determined may then be multiplied by the clean wool price of that particular grade to arrive at a per pound value for grease wool. Careful use of this procedure should provide a clean yield content that is within ±1.5% of the actual top-noil-waste yield of the lot tested, 95 times out of 100.

Coring schedules used in this report were calculated on the basis that domestic wools have a between-bag (or bale) standard deviation of 2.0 percent and a within-bag (or bale) standard deviation of 5.0 percent. These deviations were established possibly 15 or more years ago. In 1948-50 another check was made and it was found that the within- and between-bag variations had remained unchanged.

Again in 1954 individual cores from 34 lots were processed as a check on standard deviation. This work revealed a substantial drop in standard deviations, with the within-bag down to 4.20 percent and the between bag variation reduced to 1.11 percent. It is reasonable to assume that this variation decline has been brought about by better grading and preparation practices on the part of producers, wool handlers, and warehousemen and by improved selection and breeding procedures by growers. With this in mind an exhaustive study should be made in an effort to reduce the number of bags it is necessary to core and the number of cores it is necessary to draw from each bag.

As breeding and selection programs, warehouse preparation practices, and sampling techniques improve it is possible to sample and analyze lots of graded wools for clean yield determination with increased accuracy.